PINNOCK'S CATECHISMS.

A CATECHISM OF ANATOMY;

FOR THE

Instruction of Youth

IN THE

FIRST PRINCIPLES OF THAT SCIENCE.

LONDON:
PRINTED FOR GEO. B. WHITTAKER,
AVE-MARIA LANE.

1825.
Price Nine-pence.

ADVERTISEMENT.

A KNOWLEDGE of the parts of the human frame, their relative positions and uses, is confessedly of the highest importance. To supply that knowledge, in a small compass, has been the object of the composer of the following Catechism. Within so small a space, great minuteness was not to be expected; yet he trusts, that nothing of consequence to those for whose use it is intended will be found wanting. This at least he will venture to assert, that the person who will have studied it carefully, will be perfectly secured from all danger of falling into the ridiculous mistakes so common to those unacquainted with the principles of Anatomy; and, as he has been careful to explain the use, and the different functions of each part, it will be found free from the dryness inseparable from a mere catalogue of names.

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A
CATECHISM
OF
ANATOMY.

CHAP. I.

INTRODUCTION.

Q. WHAT is Anatomy?

A. Anatomy is the science that treats of the structure of organized living bodies, and explains the uses of all their parts.

Q. What is an organized body?

A. A body, all whose parts are mutually adapted to each other, for the performance of some foreseen actions.

Q. How many kinds of organized bodies are there?

A. Two; natural and artificial.

Q. What is the difference between them?

A. The former are framed by the hand of nature, and, besides the fit adaptation of the parts, contain the unknown principle of life; the latter are made by men, and are set in motion by the material powers of gravity or elasticity.

Q. Give some examples of these different kinds.

A. A tree, a horse, a man, are natural organized bodies; a watch is an artificial one.

Q. How many kinds of anatomy are there?

A. Three; vegetable, or that of plants; comparative, that of the inferior animals; and human, that of man.

Q. Is human anatomy of much use?

A. Of the greatest. By means of the knowledge of the structure of the human body, and functions of its various parts, acquired by this science, the surgeon is enabled to remedy external injuries, and the physician to treat internal diseases.

Q. But is there not something cruel and unnatural in cutting up the bodies of our fellow-creatures for the sake of this knowledge?

A. Certainly not; for though it may at first be repugnant to our feelings; yet, when we consider that there is no other mode of attaining to this knowledge, which enables us to alleviate and remove so much pain and misery, and that a dead body is totally insensible to pain, we surely cannot charge with cruelty those who have recourse to it.

Q. What further argument can be brought in favour of anatomy?

A. This science furnishes us with the most striking and convincing proofs of the wisdom and goodness of our Creator; for the instances of benevolent contrivance, which every moment meet our view, are such as can hardly fail to strike the most careless or most prejudiced observer.

Q. From what language are the terms employed in anatomy derived?

A. Principally from the Greek.

Q. What is the cause of this?

A. The earliest writers on medical subjects with whom we are acquainted are the celebrated Hippocrates, and those who succeeded him, who all wrote in that language; and as the Romans derived their medical, as well as other sciences from the Greeks, they adopted the terms used by them, and so transmitted them to us.

CHAP. II.

DEFINITIONS.

Q. OF what does the human body consist?

A. Of solids and fluids.

Q. How are the solids divided?

A. Into hard and soft.

Q. What are the hard solids?

A. Bones and cartilages.

Q. What are the soft solids?

A. Muscles, nerves, the viscera, and the other soft parts of the body.

Q. What are the fluids?

A. Blood, chyle, and the various humours secreted or separated from the blood.

Q. Of what do the solids consist?

A. Of earthy particles joined by an *intermediate gluten.*

Q. What is a *fibre?*

A. When the elementary particles are joined together in a regular order, they form a *simple fibre.*

Q. What is a *lamina* or *layer?*

A. A number of fibres put together by their breadth, or side by side.

Q. What is *cellular structure?*

A. Cellular structure, called also *cellular tissue* and *cellular membrane,* is formed by the union of a number of laminæ put together without any order.

Q. What is a *membrane?*

A. Compact or condensed cellular structure.

Q. What is a *ligament?*

A. A thick, strong, and elastic membrane.

Q. What is *cartilage?*

A. Cellular structure filled and distended with a hard, elastic, milk-coloured jelly.

Q. What is a *nerve?*

A. A nerve is a small bundle of fibres, of a pulpy substance of a peculiar kind, connected together by cellular tissue.

Q. What is a *muscle?*

A. A muscle is a body composed of fibres of a peculiar substance, of nerves and vessels.

Q. What are *tendons?*

A. Tendons are the beginning or endings of muscles; they are of a glittering silver-colour.

Q. What are *blood-vessels* and *absorbents?*

A. They are hollow canals, formed of membranes, nervous and muscular fibres, and cellular substance.

Q. What are *glands?*

A. Glands are bodies composed of cellular structure, nerves and vessels, or of a peculiar substance.

Q. What is a *viscus?*

A. A viscus is a part which performs some determinate office; as the lungs, the brain, the skin, &c. &c.

Q. Of what is a viscus composed?

A. Of a *peculiar substance;* of vessels, nerves, and cellular tissue.

Q. Into how many parts is the science of anatomy divided?

A. Into nine parts.

Q. Enumerate them?

A. *Osteólogy*, the doctrine of the bones; *syndesmólogy*, that of the ligaments; *myólogy*, of the muscles; *bursa'logy*, of the *bursæ mucosæ; angiólogy*, of the vessels; *adenólogy*, of the glands; *splanchnólogy*, of the viscera; and *hygrólogy*, of the fluids.*

CHAP. III.

OSTEOLOGY.

Q. WHAT are *bones?*

A. Bones are hard, compact, solid, and insensible substances.

Q. Of what do bones consist?

A. Of calcarious earth, of gluten, of nerves, blood-vessels, and absorbents.

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* Want of space does not permit of the derivations being given; but most terms will be found to be explained as here. From the complex nature of the human frame, it has also frequently been necessary to mention parts which have not yet been described.

Q. Of how many kinds is the *substance* of bones?

A. Of three kinds; *compact*, as in the bodies of the long bones; *spongy*, as in the extremities of the long bones; and *reticular*, as in the cavities of bones that have marrow.

Q. Are bones always equally hard?

A. No; in infants they are flexible, not apt to break, and when broken readily reunite; in old men, on the contrary, they are hard and brittle, and if broken hardly unite again.

Q. What is the cause of this?

A. In the bones of infants, the organized animal part prevails in their structure; in youth, it and the calcarious earth are nearly equal in quantity; but in old age the latter greatly predominates.

Q. What are the uses of the bones?

A. To support the body, to sustain the muscles by which all motion is performed, and to protect the viscera.

Q. What would be the consequence of the absence of the bones, or *osseous system?*

A. We should be incapable of standing upright or of moving: we should consequently be incapable of procuring food, and, as all the viscera would be exposed to external injuries, our existence would come to a speedy termination.

Q. What is a *skeleton?*

A. When the soft parts of the body are removed and the bones all put together in their natural order, it is called a skeleton. If the bones are united by their ligaments, the skeleton is termed *natural;* if by means of wires, it is called an *artificial skeleton.* The latter kind is the best, as the ligaments shrink and contract.

Q. How is the skeleton divided?

A. Into the head, trunk, and extremities.

Q. How are the bones of the head subdivided?

A. Into those of the *cranium*, or skull; those of the *face;* the *dentes,* or teeth; those of the *ear;* and the *os hyoides,* or bone of the *tongue.*

Q. How many bones are there in the *cranium?*

A. Eight.

Q. Name some of the principal ones?

A. The *os frontis,* or bone of the forehead; and the *ossa temporália,* or bones of the temples.

Q. Is there any thing particularly deserving of notice in the bones of the temples?

A. Yes; they consist of two parts, a *squamous,* or *scaly portion,* which is flat; and a *petrous portion,* which is thick and *rocky,* and contains the organ of hearing.

Q. What is the use of the bones of the cranium?

A. To protect the brain.

Q. What is most remarkable in the bones of the *cranium?*

A. That they are mostly very thin and hard, and are united by the species of articulation called *suture.*

Q. Are the bones of the cranium in a new-born infant united?

A. No, they do not in general unite until the third year.

Q. What is the reason of this?

A. In order that during birth the size of the head may be lessened.

Q. Why are there so many bones in the cranium?

A. To admit of greater compression during the birth, to facilitate the process of ossifications, and in order that fractures may not spread far.

Q. Which is the thickest bone in the skull?

A. The occipital bone, situated in the back of the head.

Q. What may be supposed to be the reason of this?

A. The occipital bone has to defend that part of the brain called the *cerebellum,* the least injury to which proves fatal. It may farther be observed, that when we fall forward, the hands contribute to protect us; and if on one side, the shoulder in some measure protects the head; but if backwards, there is nothing to interpose, and the back of the head comes with great force to the ground: it was therefore necessary that the bone placed there should have some strength.

Q. How many bones are there in the face?

A. Fourteen.

Q. How are they divided?

A. Into those of the upper, and those of the lower jaw.

Q. How many are there in the upper jaw?

A. Thirteen; two superior maxillary, two nasal, two palatine, two jugal, two inferior spongy, two lacrymal and the vomer.

Q. Describe the situation of these bones?

A. The maxillary form the upper jaw; the nasal form the nose; the palatine the palate or roof of the mouth; the jugal or malar are the cheek-bones; the spongy bones are in the side and lower part of the nostrils; the lacrymal at the internal angle of the orbit of the eye, separating it from the nostril; and the vomer sustains and divides the cavity of the nostril.

Q. How many bones are there in the lower jaw?

A. But one in the adult, called the lower jaw-bone.

Q. What are the *teeth?*

A. The teeth are hard bones, covered with a peculiar white polished substance, called *enamel.* They are fixed in the upper and lower jaw-bones.

Q. How many teeth are there?

A. The complete number in a grown person is thirty-two; sixteen in each jaw.

Q. How are they divided?

A. Into eight *incisóres,* or cutting teeth, four in each jaw, and situated in the front of the mouth; these are succeeded by four *cuspidáti,* or dog teeth, one on each side of the incisores; then eight *bicuspides*; and lastly, twelve *molàres,* or grinders.

Q. What are the *wise teeth?*

A. The wise teeth, or *dentes sapientiæ*, are the two last of the molares; they are the teeth that always appear last.

Q. At what time do teeth begin to appear?

A. About the seventh month a set of teeth begin to appear, called the *milk-teeth;* these gradually fall out about the seventh year, and are succeeded by a new set, which had hitherto lain in the cavities beneath them.

Q. Why are not children born with teeth?

A. Teeth would be useless to the new-born infant, and would cause a great deal of pain to the mother. It is therefore wisely provided that they should not begin to appear till about the time of weaning the child.

Q. What are the bones of the ear?

A. There are four bones in the ear, called the *mál-leus*, the *incus*, the *stapes*, and the *orbicula're*, from their resemblance to a hammer, an anvil, a stirrup, and a ball.

Q. Where is the *os hyoides*, or bone of the tongue, situated?

A. Between the basis of the tongue and the *larynx* or windpipe.

CHAP. IV.

OSTEOLOGY *(continued)*.

Q. How is the trunk divided?

A. Into the spine, the chest, the loins, and the pelvis.

Q. What is the *spine?*

A. The spine is a long, bony, cartilaginous tube, extending from the occipital bone of the head to the *os sacrum* at the termination of the trunk.

Q. What is the use of the spine?

A. The spine is intended to support the body in an erect posture; and also to allow it to bend; to supply a tube to contain the *spinal marrow* upon which voluntary motion depends; to afford a basis for the insertion of the muscles of the trunk, and a support for the ends of the ribs.

Q. Is the spine a single bone?

A. No; it consists of twenty-four pieces called *ver'tebræ.*

Q. How then can it support the body, be flexible, and supply a tube for the spinal marrow at the same time?

A. In this manner; the surfaces of the vertebræ are broad, and between them lies the *intervértebral substance,* resembling *cartilage* or gristle and compressible like cork; and as the broad surfaces of the vertebræ, by means of their *processes* or projections, interlock in each other, and so are firmly united, the whole spine by means of the intervertebral substance, may bend without any bone being put out of its place.

Q. But how is the safety of the spinal marrow provided for?

A. Each vertebræ has a *fora'men,* or hole in it, and these *fora'mina* exactly correspond to each other, so that one continual tube is formed; and as the vertebræ only bend in their middle, no injury can be done to the spinal marrow.

Q. But if the spinal marrow is thus shut up, how can it communicate with the rest of the body?

A. For this too we find an adequate provision made. There are four *notches* in each vertebræ, two on each surface. When two vertebræ are put together, the corresponding notches form *fora'mina,* through which the nerves pass out, and the blood vessels enter to nourish the spinal marrow.

Q. Can we observe those contrivances without seeing the human body dissected?

A. Yes; for as nature is uniform in her works she employs the same expedients in the bodies of men and of the inferior animals, only varying them according to circumstances. We may therefore observe the structure of the vertebræ in a loin of veal, and the back of a hare or rabbit offers a good view of the mode and firmness of union between them.

Q. How are the twenty-four vertebræ divided?

A. Into seven *cer′vical*, or of the neck; twelve *dorsal*, or of the back; and five *lumbar*, or of the loins.

Q. What is the *chest?*

A. The *thorax*, or chest, forms the upper part of the trunk. It consists of the twelve dorsal vertebræ, the sternum, and twenty-four ribs.

Q. What is the use of the chest?

A. To contain and defend some of the most important viscera, the lungs and the heart.

Q. What is the *sternum?*

A. The sternum, or breast-bone, is an oblong flat bone placed in front of the thorax and the true ribs.

Q. What are the ribs, and why do you say the true ribs?

A. The ribs or *costæ* are semicircular bones, twelve on each side, and extending from the dorsal vertebræ, to which they are attached, towards the sternum, to which they are united by cartilages. Fourteen of them are named *true* ribs, because their extremities are fixed to the sternum; and the other ten are called *false* ribs, as their extremities do not reach the sternum.

Q. As the false ribs are below the sternum, how are they united to it?

A. The cartilage of the eighth or first false rib is attached to that of the seventh or last true rib; the cartilage of the ninth is attached to that of the eighth, and so on, the cartilage of each rib being shorter than that of the rib above it. The two last are not fixed, but hang loosely, supported by ligamentary fibres.

Q. What are the bones of the loins?

A. The five lumbar vertebræ.

Q. What is the *pelvis?*

A. The pelvis, so named from its resemblance to a barber's basin, forms the basis of the trunk. It consists of four bones—two *ossa innomina'ta,* the *os sacrum,* and the *os coc'cygis.*

Q. Where is the *os sacrum* situated?

A. At the extremity of the spine, and is by some considered a part of it.

Q. Where is the *os coccygis* situated?

A. The *os coccygis,* so called from its resemblance to a cuckoo's bill, is at the extremity of the *os sacrum;* after the age of twenty they unite and form one bone.

Q. What organs lie within the pelvis?

A. The internal organs of generation, the urinary bladder, the rectum, and sometimes part of the small intestines.

CHAP. V.

Osteology (*continued*).

Q. What are the bones of the upper extremities?

A. Those of the shoulder, arm, fore-arm, and hand.

Q. What are the bones of the shoulder?

A. The *scapula,* or shoulder-blade, and the *cla'vicle,* or collar-bone.

Q. Where is the scapula placed?

A. In the upper and lateral part of the back.

Q. What is the use of it?

A. To defend the back, and to furnish an articulation for the arm.

Q. Where is the clavicle situated?

A. Across the upper lateral part of the chest.

Q. What is the use of it?

A. To connect the scapula and *humerus,* or bone of the arm with the chest; to give origin to muscles, and to regulate the motion of the scapula.

Q. What are the bones of the arm?

A. The arm, or *bra'chium* has but one bone—the *os bráchii*, or *húmerus*.

Q. What are the bones of the fore-arm?

A. The fore-arm contains but two bones—the *ulna* and *radius*.

Q. What are the bones of the hand?

A. The bones of the hand consist of those of the *carpus*, *metacarpus*, and *fingers*.

Q. Where is the carpus situated?

A. The carpus or *wrist* lies between the fore-arm and metacarpus.

Q. How many bones are there in it?

A. Eight, lying close to each other, in two rows; one superior, and the other inferior.

Q. Where is the metacarpus situated?

A. Between the carpus and the fingers.

Q. Of how many bones is it composed?

A. Of five, one metacarpal bone of the thumb, and four of the fingers.

Q. Where are the fingers situated?

A. The *digiti manus*, or fingers, are situated at the extremity of the metacarpus, and consist of a thumb and four fingers.

Q. How many bones are there in them?

A. Fourteen; two in the thumb, and three in each of the fingers.

Q. What are they called?

A. They are named *phálanges*, from a Greek word, signifying the ranks of an army, because they are placed in regular rows.

Q. What is the use of the hand?

A. The hand is one of the most important parts of the human frame, and the various actions it enables us to perform form one of the principal distinctions between man and the lower animals; man by his superiority of intellect could perform but little, had he not the advantage of such an instrument. We find that animals, such as the monkey, who has a hand like that of man, and the elephant, whose trunk answers the same purposes, manifest greater intelligence than other animals.

Q. What are the bones of the lower extremities?

A. Those of the *thigh*, *leg*, and *foot*.

Q. How many bones are there in the thigh?

A. But one; the *os fémoris*, *femur*, or *thigh-bone*, the largest bone in the body.

Q. How many bones are there in the leg?

A. Three; the *tíbia*, *fibula*, and *patella*.

Q. Where is the tibia situated?

A. Between the femur and the *tarsus*, in the inside of the leg. Its anterior ridge forms what is called the *shin*, and a process at its *lower head* forms the inner ankle.

Q. What is the fibula?

A. The fibula is a long bone, situated in the outer part of the leg by the side of the tibia; a process at its lower extremity forms the outer ankle.

Q. What is the patella?

A. The patella, rótula, or knee-pan, is a small triangular bone, situated between the inferior extremity of the thigh-bone and the upper part of the tibia.

Q. What is the use of the patella?

A. To strengthen the knee-joint, and to serve as a pulley for the extensor muscles of the tibia.

Q. Which are the bones of the foot?

A. Those of the *tarsus*, *metatarsus*, and *toes*.

Q. Where is the tarsus situated?

A. The tarsus, or heel, lies between the leg and metatarsus.

Q. How many bones are in the tarsus?

A. Seven.

Q. How are they arranged?

A. In two rows.

Q. Which are the principal of them?

A. The *astra'gelus*, or instep, which is in the first row, and, with the tibia and fibula, forms the ankle-joint; and the *os calcis*, or *calca'neum* in the same row, which is the largest bone in the tarsus: it forms the projection of the heel, and the *tendo achillis* is fixed in it.

Q. Where is the metatarsus situated?

A. The situation of the metatarsus is between the tarsus and the toes.

Q. How many bones does it contain?

A. Five, which form the back and sole of the foot.

Q. How many bones in the *toes?*

A. The toes, or *digiti pedis*, contain fourteen bones; two in the great toe, and three in each of the others.

Q. What are they called?

A. Phalanges, the same as those of the fingers, and for the same reason.

Q. What are the *ossa sesamoídea?*

A. The ossa sesamoídea are small bones about the size of a pea, and situated occasionally about the joints of the thumb, and great toe.

Q. Enumerate the bones of the human body?

A. In the cranium eight; in the face fourteen; the teeth thirty-two; the os hyoides; the bones of the ears eight; the vertebræ of the spine twenty-four; the os sacrum and oc coccygis; the ossa innominata; the sternum; the ribs twenty-four; the bones of the shoulders four; those of the arms two; of the fore-arm four; of the carpus sixteen; of the metacarpus ten; the phalanges of .the fingers twenty-eight; of the thigh two; of the leg six; of the tarsus fourteen; of the metatarsus ten; the phalanges of the toes twenty-eight; and the sesamoid bones of the thumb and great toe eight.

Q. How many in all?

A. In all, two hundred and forty-eight.

CHAP. VI.

Of the Connexion of Bones.

Q. What are the connexions of bones called?

A. Joints or articulations.

Q. How many kinds of joints are there?

A. Three; *diarthrósis*, which admits of motion; *synarthrosis*, which does not admit of motion; and *syon'physis*, when the bones are united by an intervening substance.

Q. How many species of diarthrosis are there?

A. Five; *enarthrósis*, or the ball and socket-joint, when the round head of one bone is received into the *deep* cavity of another, so as to admit of motion in every direction; as the head of the thigh-bone with the aceta'bulum of the os innominatum: *arthródia*, when the round head of a bone is received into a *shallow* cavity of another; as the head of the humerus with the glenoid cavity of the scapula, the clavicle with the sternum and with the scapula: *gin'glymus*, or the hinge-joint, which admits only of motion backwards or forwards, as the knee and elbow joints, those of the fingers and toes: *trochoídes*, when one bone rotates upon another; as the first cervical vertebra upon the *odontoid* process of the second, and the radius upon the ulna: *amphiathrósis*, when the motion is very obscure; as the motion of the metacarpal and metatarsal bones.

Q. How many species are there of synarthrosis?

A. Four; *suture*, where the union is by means of toothed margins; as in the bones of the cranium, which interlock like the edges of two saws placed together: *harmony*, when the union is by means of rough edges not toothed; as in the bones of the face: *gomphósis*, when one bone is fixed in another, as a peg in a board; as the teeth in the alvi'oli of the jaws: *schyndílysis*, when one bone is furrowed into another; as the bones of the septum narium.

Q. How many species are there of symphysis?

A. Five; *synchondrósis,* when a bone is united to another by means of an intervening cartilage; as the vertebræ of the spine: *syssarcosis,* when a bone is connected with another by means of an intervening muscle; as the os hyoides with the sternum: *syneurósis,* when a bone is united to another by an intervening member; as the bones of the head in the new-born infant: *syndesmósis,* when the connexion is formed by means of an intervening ligament; as the radius with the ulna: *synosto′sis,* when two bones originally separated, are united to one another by bony matter; as the occipital bone with the sphæ′noid.

Q. How many kinds of motion does the head perform?

A. Two; one backwards and forwards, as in nodding; another rotatory, as when we turn the head round.

Q. How are these motions provided for?

A. In this manner: the occipital bone of the head is united to the first cervical vertebræ or atlas by ginglymus, by which means the head can move up and down; and the second vertebræ has a tooth-shaped process, to which there is a socket corresponding in the atlas, and around which the atlas, and with it the head, moves freely as far as the ligaments permit.

Q. Is there any remarkable mechanical contrivance which resembles this?

A. Yes; that by which a telescope in a frame, is capable of having its end elevated or depressed, or of being turned round and directed to any point.

Q. How are the ribs united to the spine?

A. By ginglymus, the end of the rib is divided into two surfaces by a middle ridge; the surfaces apply themselves to the bodies of two adjacent vertebræ and the ridge to the cartilage; the ribs can therefore move backwards and forwards to aid in respiration, and by the mode of their setting on they add to the strength and firmness of the spine.

Q. Why are there so many joints in the hands and feet?

A. By means of the numerous joints of the hands, we are enabled to grasp, and to judge of the size and forms of bodies, and to perform several operations which require a variety of motions; and those of the feet assist us in preserving our balance, and in standing upright, and also enable us to perform several progressive motions with greater ease; as in leaping from a height, we always endeavour to come on our toes, for then the force of the fall is broken by communication to the articulations of the tarsus and metatarsus, and the spine and head saved from dangerous concussions; if the sole of the foot should strike at once on the ground, fractures of the neck and thigh-bone, and concussion of the brain might ensue.

CHAP. VII.

Of Cartilage, and the Membranes of the Bones.

Q. WHAT is *cartilage?*

A. Cartilage, or gristle, is a white, elastic, glistening substance growing to the bones.

Q. How many kinds of cartilage are there?

A. Three; the *obducent*, which covers the tops of the bones at the joints; the *interarticular*, which is not united to the bone, but lies within the joint; and the *uniting* cartilages, which unite bones firmly together, as the bodies of the vertebræ.

Q. What is the use of the *obducent* cartilage?

A. To permit, by means of its smoothness and elasticity, the bones to play freely on each other.

Q. What is the use of the *interarticular* cartilage?

A. The interarticular cartilage is placed within joints that have to perform a variety of motions, as that of the lower-jaw, or to sustain a great pressure, as the knee-joint, to ease the friction; and this contrivance greatly resembles that of putting loose rings on the crook-hinges of heavy gates, or under the head of the great screw of a smith's vice.

Q. What is the *periostium?*

A. The periostium is a membrane which covers the external surface of all the bones, except the crowns of the teeth.

Q. What is the periostium of the cranium called?

A. It is called the pericranium.

Q. What is the use of the periostium?

A. To distribute vessels on the surfaces of the bones and to give them smoothness, that the muscles may move on them with greater ease.

Q. What is the *membra'na medulla'ris?*

A. The membrana medullaris is the internal lining of the bones; it forms the little bags that contain the marrow.

CHAP. VIII.

SYNDESMOLOGY.

Q. WHAT are *li'gaments?*

A. Ligaments are strong, elastic membranes, connecting the extremities of the moveable bones.

Q. How many kinds of ligaments are there?

A. Two; the *cap'sular,* and the *connecting* ligaments.

Q. What are the capsular ligaments?

A. Those which, like a bag, enclose and surround the joints.

Q. How do they perform this office?

A. They arise from the receiving-bones, and are inserted round the received bones a little below their heads, and thus enclose the joints on every side, keep the bones close together, and retain the *syno'via,* or fluid by which the joints are moistened to prevent the ill effects of friction.

Q. How are the connecting ligaments divided?

A. Into external and internal.

Q. What are the *connecting* internal ligaments?

A. Ligaments which occur in the inside of some ball and socket-joints. One end of them is inserted in the ball and the other in the socket. They are exceedingly strong and flexible; and as, from their situation, they are effectually secured from injury, they add greatly to the firmness of the joint.

CHAP. IX.

Myology.

Q. What is a *muscle?*

A. A muscle is a collection of fibres capable of contraction and relaxation.

Q. How is a muscle divided?

A. A muscle is divided into *head*, *belly*, and *tail.*

Q. How do muscles adhere?

A. The head and tail are firmly attached to the bones; the body of the muscle adheres loosely to other parts by means of the cellular membrane, in order that it may swell when the muscle acts.

Q. What is the *origin* of a muscle?

A. The origin of a muscle is the place of attachment of the head, and is the part nearest the trunk of the body.

Q. What is the *insertion* of a muscle?

A. The attachment of a muscle to the part that is to be moved.

Q. What is the substance of a muscle?

A. A muscle is *fleshy* in the belly, and *tendinous* in the extremes.

Q. Of what is a muscle composed?

A. Of bundles of fibres, each of which bundles is contained in a cellular sheath.

Q. Is there any difference between the fibres of the belly and those of the extremities?

A. Yes; the former are irritable and sensible, the latter are not so.

Q. Do they differ in colour?

A. No; for though the fibres of the belly appear of a red colour, this is owing to the quantity of blood-vessels mixed with them, and this colour may be removed by washing, and the muscular tissue remains of a white colour.

Q. What is a *tendon?*

A. When the tendinous extremity of a muscle is rounded, it is then simply called a tendon.

Q. When the tendinous extremity of a muscle is not rounded, what is it called?

A. When it is not rounded, but is broad and extended, it is termed an *aponeuro'sis,* and sometimes a *fascia.*

Q. From what do the different muscles take their names?

A. Sometimes from the arrangement of their fibres; sometimes from their action; at others, from their origin and insertion, or from their figure and situation.

Q. Mention some examples of muscles named from the arrangement of their fibres.

A. When the fibres run in the same direction, the muscle is said to be *simple;* when they are in rays, it is called a *radiated* muscle; when they are arranged like the plume of a feather, a *penniform* muscle.

Q. Can you give any instances of muscles named from their action?

A. Yes; there are the *flexors, extensors, depressors, leva'tors, &c.*

Q. Can you mention any which derive their names from their origin and insertion?

A. Yes; the *sterno-hyoideus, crico-hyoideus,* and several others situated about the throat and breast.

Q. Name some of those which derive their appellations from their figure.

A. The *trape'zius*, *scalœ'nus*, and *rhomboi'des*, muscles of the back, so named from their resemblance to particular geometrical figures; and the *pyramida'lis*, in the anterior part of the abdomen.

Q. Did you not say that some were named from their situation?

A. Yes; such as the *tempora'lis* and *pectora'lis*, the *lingua'lis*, so called from their vicinity to the *temples*, *breast*, and *tongue*.

Q. How are muscles arranged?

A. Muscles are mostly arranged in pairs.

Q. What are those that occur in producing the same action called?

A. They are called *congéneres*.

Q. What are those that act contrary to each other called?

A. They are called *antagonists*.

Q. What is the use of muscles?

A. It is by means of the muscles that motion is produced.

Q. How do muscles act?

A. By contraction.

Q. In what manner?

A. The belly of the muscle contracts and swells, and consequently draws the two extremities; and as the tail is inserted in the periostium of the bone to be moved, if some external impediment does not occur, the bone is drawn, and motion is produced.

Q. How many kinds of muscular motions are there?

A. Three; *voluntary* motion, which proceeds from the direct operation of the will; as when we raise the arm, bend the leg, or move the tongue at our will: *involuntary*, when the muscles act as it were of their own accord; as the contraction and dilatation of the heart, the motion of the stomach, intestines, &c.: and *mixed*, when the muscles act partly under the control of the will, but usually without our being conscious of their motion; as in the muscles of respiration.

Q. What is meant by the *irritability* of a muscle?

A. The power of contracting, independently of the will, when touched or wounded, or otherwise irritated.

Q. In what muscles is irritability the greatest?

A. The irritability of muscles is directly proportioned to the number and magnitude of the nerves and arteries distributed in them. The tongue receives the greatest supply of nerves, and is the most subject to volition.

Q. You said that antagonist muscles acted in opposition to each other; explain that.

A. If one set of muscles, for example, bend a limb, there is always another set provided to restore it to its former position. Thus there are muscles situated in the back part of the thigh to bend the leg, and a corresponding set, antagonist to the first, placed in the fore-part of the thigh to straighten the leg.

Q. Do these antagonist muscles answer any other purpose?

A. Yes; by acting against each other they preserve the symmetry of the body. Thus, by means of antagonist muscles, the mouth is retained in the middle of the face, and its angles kept exactly corresponding.

Q. When the action of muscles is required in a part where their position would be inconvenient, what plan is adopted?

A. They are placed in some other part where they not only cause no inconvenience, but are a source of beauty, and they communicate by means of long tendons with the part to be moved.

Q. Give an example of this.

A. The muscles that move the fingers could not have been placed in the palm or on the back of the hand without, in a great measure, disqualifying it for the purposes it was intended to answer, besides greatly subtracting from its beauty; they are therefore placed in the fore-arm, near the elbow, and there form a graceful swell, and they communicate with the fingers by means of long tendons which are strapped down at the wrist, and pass under the ligaments.

Q. Can you give any other example?

A. A similar arrangement takes place with regard to the muscles that move the toes. Had they been placed on the sole and upper part of the foot, they would have impeded our motions and given to the foot an unsightly appearance; placed as they are on the calf of the leg, they cause no impediment and are a source of beauty.

Q. Give another instance of a muscle acting at a distance from its seat.

A. The manner in which the lower-jaw is drawn down is a very remarkable instance. The most obvious mode, it would appear, would have been to have fixed a muscle in the breast with a tendon attached to the chin; but the form of the neck and the freedom it requires forbid that. It was therefore necessary to devise some other mode, and the one adopted is this: A muscle rises on the side of the face considerably above the insertion of the lower-jaw, and comes down, being converted in its progress into a round tendon; this passes through a loop in the os hyoides, and then is made to ascend, and is inserted into the inner part of the chin; and consequently, when the muscle contracts as the tendon goes through the loop, the chin is pulled down.

Q. What are the principal single muscles?

A. The principal single muscles are the *di'aphragm* and the *sphincters.*

Q. What is the diaphragm?

A. The diaphragm, or midriff, is a muscle dividing the cavity of the *thorax* from that of the *abdo'men.*

Q. What is its structure and form?

A. It is fleshy towards the borders, and tendinous in the centre; and it is convex towards the thorax, and concave towards the abdomen.

Q. Whence does it arise?

A. The diaphragm arises from the lower borders of the chest, and also from the fore-part of the loins.

Q. What is the use of the diaphragm?

A. It is, next to the heart, the most useful muscle. It is the principal muscle employed in respiration, and is so perfect in this office that, even though the ribs in consequence of *anchylosis** may have become incapable of performing their part, respiration is carried on by the aid of the diaphragm without any loss being felt. It also aids the abdominal muscles in expelling the fœces and urine.

Q. What are *sphincters?*

A. Sphincters are circular muscles.

Q. What purpose do they answer?

A. To contract and retain; thus the *sphincter oris*, which forms the lips, holds the mouth in a slight degree of contraction, which can be increased when the will requires it. Their motion is of a kind called *mixed*, which exactly accords with the wants and functions of the human body.

Q. What further may be observed concerning the muscles?

A. It is a curious observation, that the most important and delicate actions are performed by the smallest muscles; such are the muscles of the *iris* of the eye, which require to be magnified by a microscope to be visible, and yet it is on them that the power of seeing in different degrees of light, and the preservation of the organ in a very strong light depend.

Q. What is flesh?

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* Anchylosis is when bones are at the joint united by a mass of bone so as to lose their power of motion.

A. Flesh is the muscular part of the body; the beef and mutton that we eat are the muscular substances of the cow and the sheep.

CHAPTER VIII.

BURSALOGY.

Q. WHAT are the *bursæ mucosæ?*

A. The bursæ mucosæ or *mucous bags*, are bags composed of a peculiar membrane, containing a kind of mucous fat, formed by the exhaling arteries of their internal surface.

Q. Are all the bursæ the same?

A. No; they are of different *sizes* and different degrees of *firmness.*

Q. How are they *connected*, and to what parts?

A. They are connected by cellular membranes, with the capsular ligaments, the tendons, bones, or ligaments.

Q. How many kinds of bursæ mucosæ are there?

A. Two; the *vascular* and the *vesicular.*

Q. What is the use of the bursæ mucosæ?

A. To supply a fluid for the lubrication of the muscles and tendons that are constantly in action.

CHAPTER IX.

ANGIOLOGY.

Q. WHAT is *Angiology?*

A. Angiology is the doctrine of the vessels.

Q. What are *vessels?*

A. Vessels are long membraneous canals which carry blood, lymph, chyle, or a secreted fluid.

Q. How are the vessels divided?

A. They are divided into arteries, veins, absorbents, and excretory ducts.

Q. Where are they situated?

A. In every part of the body, except in the epidermis,* membrana arachnoeidea,† and nails.

Q. How is this proved?

A. By *injection.*

Q. What is injection?

A. Filling by means of a syringe the vessels of the human body with liquified wax, varnish, size, or glue, variously coloured, or with quicksilver.

Q. What are *arteries?*

A. Arteries are elastic, membraneous canals, which pulsate.

Q. Whence do they arise?

A. From the ventricles of the heart.

Q. Are they all the same size?

A. No; they gradually diminish in size as they proceed from the heart towards the extremities.

Q. How do they terminate?

A. They terminate in veins or exhaling vessels, or they *anástomose*‡ with each other.

Q. What is their structure?

A. They are composed of three membranes, or *coats* or *tunics;* an *external* one; a *middle* one, which is *muscular*; and an *inner* one, which is smooth.

Q. Why have they so many coats?

A. In order to prevent rupture on account of the force with which the blood flows through them.

Q. What is the use of arteries?

A. Their use is to convey blood from the heart to the different parts of the body, for nutrition, preservation of life, generation of heat, and the secretion of different fluids.

Q. How are the arteries nourished?

A. They are nourished by their own blood-vessels, called *vasa vasórum.*

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* The outer skin. † One of the membranes of the brain.

‡ When vessels communicate with each other, they are said to *anastomose.*

Q. How many arteries, properly speaking, are there?

A. To speak accurately, there are but *two* arteries; the *pul'monary artery*, which proceeds from the right ventricle of the heart; and the *aórta*, which proceeds from the left ventricle. All the others are only ramifications of these; they are, however, all denominated arteries, and each has its appropriate name.

Q. How do the arteries act?

A. The arteries are dilated and irritated by the impulse of blood from the ventricles of the heart, and, by means of their *middle* or muscular coat, contract upon the blood and propel it to the glands, muscles bones, membranes, and every part of the body, for their nutrition, and for the various secretions; and, lastly, into the veins.

Q. What is this alternate contraction and dilation called?

A. It is called the *pulse*.

Q. Is the pulse perceptible?

A. It is perceptible in the trunks and branches of the arteries, but not in the capillary* vessels, except in case of inflammation. It is very perceptible, for example, in the wrist.

Q. The aorta, you say, proceeds from the left ventricle of the heart; what is its course?

A. It first proceeds upwards, giving off two arteries, called *córonary*† arteries to the heart, and forms an *arch* towards the dorsal vertebræ; it then *descends* through the diaphragm into the abdomen, in which it proceeds, by the left side of the spine, to the last vertebræ of the loins, where it divides into the two *iliac* arteries.

Q. What branches does the *arch* of the aorta give off?

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* From capillus, a hair; capillary tubes and vessels are those which are scarcely thicker than a *hair*.

† So called, because they surround the heart like a crown, *coróna*.

A. The arch gives off three branches, which supply the head, neck, and arms with blood.

Q. Which are they?

A. The *arte'ria innomina'ta,* which divides into the *right carotid* and right *'subclávian* arteries; the *left carótid,* and the *left subclavian.*

Q. What is the course of the carotid arteries?

A. The carotid arteries, having emerged from the chest, run up along the neck, one on each side of the *trache'a,* to the angle of the lower jaw, where they divide into *external* and *internal.*

Q. How many branches does the external carotid give off?

A. The external carotid gives off eight branches to the neck and face.

Q. What is the course of the internal carotid?

A. The internal, after leaving the external carotid, proceeds by the per vagum and intercostal nerve to the carotid canal in the pituitous portion of the temporal bone, and enters the cranium, having first given off *two* very small *twigs* to the *pitu'itous* gland, and third, fourth, and fifth pairs of nerves, and soon after entering the cranium, it sends off four branches to the eye and brain.

Q. Whence do the subclavian arteries arise?

A. The subclavian artery of the right side arises from the arteria innominata; and that of the left side from the arch of the aorta.

Q. How many branches does each subclevian artery give off.

A. Each gives off five branches, distributed over the breast, neck, and posterior, and upper part of the brain.

Q. Which are the principal of these?

A. The principal are the *inferior mam'mary,* which gives rise to four arteries; the *inferior thy'roid,* or *inferior guttural,* which also gives off four; and the *vertebral artery,* which enters the *vertebral foramina,* and ascends into the cavity of the cranium, where it unites with its fellow of the other side, and forms the *ba′silary artery*, and gives off different branches distributed through the brain.

Q. Does the subclavian artery retain its name throughout the entire of its course?

A. No; when it has arrived in the *axilla* or armpit, it takes the name of the *axillary artery*, which passes into the arm, and is then denominated the *brachial* artery; when it reaches the fore-arm, it becomes the *ulnar* or *cubital* artery, and gives off the *ràdial* artery.

Q. How many branches does the axillary give off?

A. The axillary artery gives off four branches to the breast and shoulder.

Q. How many branches does the humeral give off?

A. The humeral gives off four branches to the fore-arm.

Q. How many branches are given off by the ulnar artery?

A. The ulnar artery sends off the *recurrent branches*, which anastomose with one of the branches of the humeral artery. It sends off small branches to the adjacent muscles on its way to the wrist, and then sends off branches to the palm and fingers.

Q. What is the course of the radial artery?

A. The radial artery gives off the *radial recurrent*, proceeds to the wrist where the pulse is felt, gives off the *superficia′lis sola*, and then divides into four branches.

Q. What is the course of the aorta after it has given off the subclavian and carotid arteries?

A. It descends, and is named the *thora′cic aorta.*

Q. What branches does the thoracic aorta send off in the breast?

A. It sends off four branches; the *bron′chial*, to the lungs; the *œso′phagal*, to the œso′phagus; the *intercostals*, between the ribs; and the *inferior diaphragmatic*, or *phrenic*, to the diaphragm.

Q. How is the aorta named when it reaches the abdomen?

A. It then becomes the *abdominal aorta.*

Q. How many branches does it send off in its progress through the abdomen.

A. Eight, which are again subdivided, and are distributed through the loins and the different viscera which occupy the abdomen.

Q. Name some of the principal.

A. The *cœ'liac*, which divides into three branches, —the *hepàtic*, the *gastric*, and the *splenic* artery; and the *ural* arteries, which go to the kidneys.

Q. On quitting the abdomen, what becomes of the aorta?

A. It divides into two great trunks, and becomes the *iliac arteries.*

Q. Does the iliac artery long retain its form and size?

A. No; it very soon divides into the *internal* and *external* iliac arteries.

Q. What other name have the internal iliac arteries. ?

A. They are called *hypogastric arteries.*

Q. How many branches does the internal iliac artery give off?

A. It gives off five branches, principally distributed about the groin.

Q. How many branches does each external iliac give off?

A. Each of the external iliacs gives off but two branches; one of which, named the *epiga'stric*, is reflected upwards along the abdomen.

Q. What is the further course of the external iliac?

A. It passes under a ligament called *Poupert's ligament*, and passes along the thigh, becoming the *femoral* or *crusal* artery; gives off two principal branches, and, on reaching the ham, takes the name of the *poplitial* artery; and having given off several small branches about the joint, it divides, below the ham, into the *tibia'lis an'tica* and *tibia'lis pos'tica.*

Q. What is the course of the *tibialis antica ?*

A. The tibialis antica passes along the tibia over the bones of the tarsus, and then inosculates with the back arteries.

Q, How many branches does it give off in its course ?

A. It gives off six branches, distributed along the leg and foot.

Q. What is the course of the *tibialis postica ?*

A. It passes along the back part of the tibia, goes round the inner ankle, and divides at the heel into the two plantar arteries.

Q. How many branches does it send off?

A. It sends off four branches, distributed along the leg and foot.

Q. You said there was another main artery besides the aorta ; what is it called ?

A. It is called the *pulmonary artery*, and it arises from the right ventricle of the heart.

Q. What is its use ?

A. To convey into the lungs the dark-coloured blood, which is then returned, by the veins, of a bright red colour.

Q. Why does it convey the blood into the lungs ?

A. In order that it may there receive a certain principle necessary for the continuance of life, and which the arterial blood distributes to every part of the body.

Q. Does this artery divide ?

A. Yes ; it soon divides into a *right* and *left ;* the right goes to the right lung, and the left to the left lung, where they divide into innumerable branches, and form a beautiful net-work or *plexus* of vessels, upon the air vesicles, called the *rete mira'bile*, and terminate in the pulmonary veins, which convey the blood, now become florid, to the left side of the heart.

CHAPTER X.

ANGIOLOGY (*continued*).

Of the Veins.

Q. WHAT are *Veins?*

A. Veins are membraneous canals which do not pulsate like the arteries.

Q. What is the structure of the veins?

A. They are, like the arteries, composed of three membranes; but they are semi-transparent, and more delicate than those of the arteries.

Q. Where do the veins take their origin?

A. They arise from the extremities of the arteries by anastomosis.

Q. Where do they terminate?

A. They terminate in the auricles of the heart.

Q. What is their situation?

A. They run by the side of the arteries, but nearer to the surface.

Q. How are they divided?

A. They are divided into trunks, branches, &c.

Q. Is there any thing remarkable in the structure of the veins?

A. Yes, they are mostly supplied with *valves.*

Q. What are these valves?

A. They are thin, semilunar, membraneous folds, which are found in most veins.

Q. What is the use of them?

A. Their use is to prevent the blood of the vein being forced back out of its course towards the heart.

Q. How do they act?

A. They are attached to the sides of the veins, and lie in the direction along which the blood naturally proceeds; but should any cause force the blood to return, the blood gets behind the valves, and raising them up closes the passage.

Q. What farther difference, besides those already observed, may be remarked between the venous and arterial systems?

A. In the arterial system, to use the figurative language generally adopted on this subject, the order is root, trunk, branch, twigs; that is to say, the system commences at the heart, proceeds to the aorta, and so on; in the venous system the order is reversed.

Q. Which are the great *trunk-veins?*

A. They are the *vina cava superior*, which receives the blood from the head, neck, thorax, and superior extremities; the *vena cava inferior*, which receives the blood from the abdomen and lower extremities; and the *coronary vein*, which receives it from the coronary arteries of the heart.

Q. Whence is the vena cava superior supplied?

A, It receives the blood from the *right* and *left subclavian* veins, and from the *vena ázygos,* and empties it into the right ventricle of the heart.

Q. Whence do the subclavian veins receive their blood?

A. From the head and upper extremities.

Q. In what manner.

A. The veins of the fingers called *diptals* receive their blood from the digital arteries, and empty it into the *cephalic of the thumb*, which runs along the thumb, and evacuates itself into the *external radial.*

Q. Are there any other veins in the hand?

A. Yes; the *salvatella*, which runs along the little finger, and empties itself into the *internal and external cubital veins.*

Q. How do they then proceed?

A. At the bend of the fore-arm there are three veins — the *great cephalic*, the *basilic*, and the *median.*

Q. What is the course of the great cephalic?

A. This vein runs along the superior part of the fore-arm, and receives the blood from the external radial.

Q. What is the course of the basilic.

A. It ascends on the under side, and receives the blood from the external and internal *cubital veins*, and from some branches called *venæ sali'litum*, which accompany the brachiel artery.

Q. What is the course of the median?

A. It is situated in the middle of the fore-arm, and arises from the union of several branches. It is divided into two branches, called the *median cephalic*, and the *median basilic*.

Q. Do these veins proceed separately?

A. No; they unite above the bend of the arm, and form the *brechial vein*, which is continued to the axilla, and then becomes the *axillary vein*.

Q. Does the axillary receive any fresh supply of blood?

A. Yes; it receives the blood from the scapula, and from the superior and inferior parts of the chest, by the *superior and inferior thoracic vein*, the *vena muscularis* and the *scapularis*.

Q. How does it then proceed?

A. It passes under the clavicle, where it is called the *subclavian*, and unites with the *external and internal jugulars*: and the vertebral vein that brings the blood from the vertebral sinuses; it also receives blood from several veins of the interior of the chest, and the adjacent parts, and then unites with its fellow to form the *vena cava superior*, or *descendens*, as it is sometimes called.

Q. How do the jugulars receive their blood, and from whence?

A. The *frontel, faciel, auricular, sub-linguel*, and *occipital* veins receive the blood from the parts from which they are named; these all converge to one side of the neck, and form the *external jugular*.

Q. Whence is the *internal jugular* supplied?

A. The blood from all parts of the brain is received into the lateral sinuses, or veins of the dura meter, out of which it is poured into the internal jugular, which descends in the neck by the carotid arteries, receives the blood from the *thyroi'deal* and *internal maxillary* veins, and empties itself into the subclavians within the thorax.

Q. What other vein empties itself into the vena cava superior?

A. The vena azygos, after having received the blood from the *bronchial, superior œsophagal, vertebral,* and *intercostal* veins.

Q. In what manner is the blood of the abdomen and lower extremities returned by the *vena cava inferior ?*

A. The veins of the toes, called the *digital veins*, receive the blood from the digital arteries, and form on the back of the foot three branches; one on the great toe, called the *cepha'lic ;* another on the little toe called the *vena saphe'na ;* and one on the back of the foot, called the *vena dorsa'lis pedis ;* and on the sole they empty themselves into the *plantar veins.*

Q. What is the course after this?

A. The three veins in the upper part of the foot coming together, above the ankle, form the *anterior tibial ;* and the plantar veins with a branch from the calf of the leg, called the *sural vein*, form the *posterior tibial:* a branch also ascends in the direction of the fibula, called the *perone'al* vein. These three branches unite below the ham into one branch, the *subpopliteal vein* which ascends, carrying all the blood from the foot; it then proceeds upon the fore-part of the thigh, where it is termed the *crural* or *fémoral vein*, receives several branches from the muscles, and passes under Poupart's ligament into the cavity of the pelvis, where it is called the *external iliac.*

Q. What becomes of the blood of the pelvis and adjacent parts?

A. The arteries about these parts empty themselves into various veins, all of which unite in the pelvis, and form the *internal iliac.*

Q. What is the farther course of these two trunks?

A. The external and internal iliacs unite at the last vertebræ of the loins, and form the *vena cava inferior* or *ascendens*, which ascends on the right side of the spine, and having received the blood from various veins, passes through the diaphragm, and enters the right auricle of the heart.

Q. What other remarkable veins are there?

A. The *vena portæ* and the *venæ cavæ hepa'ticæ.*

Q. What is the *vena portæ?*

A. A large vein which carries the blood from the abdominal viscera into the liver.

Q. What are the *venæ cavæ hepaticæ?*

A. Veins which bring the blood into the vena cava inferior from the branches of the vena portæ.

Q. Since the veins do not pulsate, how is the blood forced along them to the heart?

A. The blood is impelled along the veins by the contractility of their coats, by the pressure of the blood from the arteries, called the *vis a tergo*, by the contraction of the muscles, and by respiration, and its return is prevented by the valves.

CHAP. XI.

Angiology—(*continued*).

Of the Absorbent System.

Q. What is absorption?

A. Absorption is the taking up of substances which are applied to the mouths of absorbents or absorbing vessels.

Q. What are the absorbents?

A. The absorbents are very thin pellucid vessels, which absorb or take up the lymph from every part of the body, the chyle from the intestines, and substances applied to the surface of the body.

Q. How are they divided?

A. Into *lac'teals* and *lympha'tics.*

Q. What are the lacteals?*

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* So called from the milky-colour of the chyle which fills them.

A. Those situated in the mésentery and intestines.

Q. What are the lymphatics?

A. Those in the other parts of the body.

Q. What is the structure of the absorbents?

A. They consist of tender, pellucid, strong tunics.

Q. What is their figure?

A. They are branching, becoming broader as they proceed towards their termination.

Q. What is their situation?

A. It is supposed that they exist in every part of the body; but they have not yet been detected in some parts; as in the brain, &c.

Q. Where do they originate?

A. In the cellular membrane, the viscera, the external surface, and every part of the body.

Q. Where do they terminate?

A. They all terminate in the thoracic duct, or the subclavian vein.

Q. What farther may be remarked concerning them?

A. That they are furnished with numerous valves, and have *lymphatic* or *conglom'erate glands* situated every where in the course of the lymphatics.

Q. What is the use of the absorbents?

A. To carry back the lymph from different parts of the body to the blood; to convey the chyle from the intestines to the thoracic duct, there to be mixed with the lymph for the formation of blood; to remove the superfluous vapour from various cavities; to prevent dropsies taking place; to remove the hard and soft parts of the body, and, lastly, to convey into the system medicines which are applied to the surface of the body.

Q. How is it shewn that the lymphatics exist in every part of the body?

A. It can be proved by experiments; but they cannot, on account of their minuteness in some parts, be demonstrated to the eye.

Q. How are the lymphatics divided?

A. Into those of the head and neck, upper and lower extremities, and those of the viscera.

Q What is the course of the absorbents of the head and neck?

A. They unite into a considerable branch that accompanies the jugular vein to the subclavian vein.

Q. How are the absorbents of the upper extremities divided?

A. Into superficial and deep-seated.

Q. What is the course of the superficial absorbents?

A. They ascend under the skin to the wrist, from whence a branch proceeds along the back of the fore-arm, and up the arm to the axilla, receiving several branches as it proceeds. Another branch proceeds from the wrist along the anterior part of the fore-arm, and forms a net-work, with a branch coming over the ulna, from the posterior part, and so ascends to the axilla also.

Q. What is the course of the deep-seated absorbents?

A. They accompany the larger blood-vessels, and ascend to the glands of the axilla. Both the superficial and deep-seated absorbents having passed through the axillary glands, form *two trunks*, which unite into *one*, which is inserted in the thoracic duct.

Q. How are the absorbents of the lower extremities divided?

A. They also are divided into superficial and deep-seated.

Q. What is the course of the superficial ones?

A. These lie between the skin and the muscles; they unite in a branch which proceeds along the leg and the thigh to the subin′guinal glands.

Q. What is the course of the deep-seated ones?

A. They follow the course of the arteries, and pass to some subinguinal glands. Both these and the superficial absorbents, having united with others, enter the thoracic duct at its commencement.

Q. What is the *thoracic duct?*

A. The thoracic duct is the trunk of the absorbents, and is of a serpentine form, about the size of a crow-quill.

Q. What is its course?

A. It commences from an oval bag, called the *receptac'ulum chyli*, lying on the back of the first lumbar vertebræ, and formed by the junction of the lymphatics of the lower extremities and of the lacteals; it then passes upwards beneath the right side of the aorta, and ascends between it and the vena azygos; it then passes between the œsophagus and the curvature of the aorta to the left side, and ascends behind the left carotid artery to the first or second dorsal vertebræ; leaving the carotid, it then makes a circular turn and divides: it unites again almost immediately, it descends behind the internal jugular vein, to the left of which it enters the angle formed by the subclavian and jugular veins.

Q. What absorbents does it receive in its progress?

A. Those of the kidneys, spleen, lungs, heart, and other viscera and muscles of the abdomen and thorax.

CHAP. XII.

Neurology.

Q. What are the *nerves?*

A. The nerves are long whitish pulpy cords, composed of bundles of fibres, which serve for sensation.

Q. Where is their origin?

A. They all arise from the different parts of the brain, or from the spinal marrow.

Q. Where do they terminate?

A. They terminate in the organs of sense, the muscles, vessels, bones, &c.

Q. What are those that arise from the brain called?

A. They are called cerebral nerves.

Q. And those from the spinal marrow?

A. Spinal nerves.

Q How are they divided?

A. Into trunks, branches, ra′muli, capillary fibres, papillæ, nervous plexuses, and ganglions.

Q. How many nerves are there?

A. Nerves are distributed in pairs, and there are thirty-nine pairs; *viz.* nine pair of cerebral, and thirty of spinal nerves.

Q. Which are the nine cerebral pair?

A. They are, 1. the olfactory; 2. the optic; 3. the oculo′rum moto′res; 4. the pathetic or trochleato′res; 5. the trige′mini or divisi; 6. the abducent; 7. the auditory and facial; 8. the par vagum or great sympathetic nerves; 9. the lingual.

Q. How are the spinal nerves divided?

A. Into eight pair of cervical, twelve of dorsal, five of lumbar, and five of sacral nerves.

Q. How are the nerves covered?

A. At their origin they are covered by the pia mater, and, at their egress from the skull and spine, by the dura mater, which last forms the sheath of the nerve, and appears as a firm cellular membrane; but when the nerve arrives at its destination, it appears in a soft pulpy state.

Q. What are *nervous plexuses?*

A. When nerves are woven together like a net, they form a plexus.

Q. Where do the plexuses chiefly occur?

A. About the abdominal viscera.

Q. What is a *ganglion?*

A. The ganglions, or knots of nerves, are whitish-red bodies, of various sizes and figures; they are found in the course of many of the nerves, and are somewhat harder than a nerve.

Q. What is their use?

A. The use of the ganglions is not known.

Q. What is the use of the *nervous system?*

A. The nerves are the organs of sensation, and constitute the organs of the five senses—touch, taste, smell, hearing, and sight; neither can the muscles act without nervous influence.

Q. How are nerves situated?

A. They are generally imbedded in fat or cellular substance, and pass along the interstices of muscles and the grooves of bones; but some of the larger branches run contiguous to arteries.

Q. How do they separate?

A. They usually break off from each other at an acute angle, and the branches are not proportionably smaller than the trunks from which they proceed.

Q. Do the nerves run into one another like the veins or arteries?

A. No; each fibre of the nerves has its separate sheath, independent of the common sheath of the nerve, and extends, uninterrupted, from its origin to its termination; these fibres, therefore, unite, or are separated from each other, but do not run into one another.

Q. What farther may be observed concerning the nerves?

A. That their structure differs according to their situation: thus the fibres of the optic nerve are not furnished with membraneous coverings; and the pia mater alone furnishes a sheath to the cord formed by the union of the filaments; and the nerves, which pass along osseous canals, have no cellular covering, and their consistence is always greater than that of nerves which are surrounded by soft parts.

Q. Is there any other remark to be made?

A. Yes; there seems to be a relation between the softness of the nervous extremity and the nature of the bodies intended to produce an impression on them. Thus the almost fluid state of the *re'tina* of the eye is evidently adapted to the subtile nature of light, which could make no impression but on a substance capable of being set in motion by the slightest impulse.

Q. What is the difference between the cerebral and spinal nerves?

A. In texture there does not appear to be any; but the cerebral nerves are subservient to the mental powers, and the spinal are chiefly employed in producing motion.

Q. Which is the most remarkable nerves of the body?

A. The par vagum, or great sympathetic nerve.

Q. What is its course?

A. It arises from the brain, and proceeds along the spine, receiving branches from all the nerves of the spinal marrow. It supplies nerves to those viscera, as the heart, stomach, &c., whose action is independent of the will; and it is by these nerves that the mind and stomach so mutually affect each other.

CHAP. XIII.

ADENOLOGY.

Q. What is a *gland?*

A. A gland is a small, round vascular body, which serves for the secretion or alteration of a fluid.

Q. How are glands divided?

A. Into folli′culose globate, glo′merate and conglomerate. They are also divided, from the liquor they secrete or change, into seba′ceous, muci′parous, lymphatic, la′chrymal, sa′lival, bilious, lacteal, &c.

Q. What is a *folliculose gland?*

A. One consisting of a hollow, vascular membrane, having an excretory duct; as the muciparous and sebaceous glands.

Q. What is a *globate gland?*

A. A globate gland consists of a number of lymphatic vessels, connected together by cellular membranes, without any cavity or excretory duct; as the lymphatic glands.

Q. What is a *glomerate gland?*

A. One formed of a collection of blood-vessels; and which has no cavity, but has an excretory duct; as the lachrymal glands.

Q. What is a *conglomerate gland?*

A. A gland composed of many glomerate glands, whose excretory ducts unite and form one large canal, as the pancreas and salival glands.

Q. What is the excretory duct of a gland?

A. A thin canal which goes out of the gland and ejects the secreted fluids by means of the contractility of its coats.

Q. Have the glands many nerves and vessels?

A. Yes; the nerves and vessels of the glands are numerous, and mostly come from the neighbouring parts.

Q. How are glands connected with other parts?

A. By cellular tissue.

Q. You said that the secretion of fluids was the office of the glands; what is secretion?

A. Secretion is a particular function in an animal body, by which a fluid is separated from the blood, which fluid is different from the blood.

Q. What is the process of secretion?

A. We know not; all we can discover is, that the blood is carried into the gland by an artery, a portion of it carried out of it by a vein, and the secreted fluid discharged by the excretory duct.

Q. Can you mention any excretory duct, the construction of which is remarkable for its mechanism?

A. Yes; the excretory duct of the paro′tid gland. This gland, which produces a great portion of the sali′va or spittle, lies between the ear and the angle of the lower jaw, the duct passes along the outside of the jaw, and passing over one muscle, bores itself a hole through another in the middle of the cheek, and so discharges the fluid into the mouth where it is required.

Q. Name some of the principal glands.

A. The lachrymal glands, which secrete the tears; the mammillary glands, which secrete the milk; the hepatic glands, the pancreatic glands, the kidneys, &c.

Q. What are the principal secretions?

A. The bile, the gastric juice, the saliva, the urine.

CHAP. XIV.

SPLANCHNOLOGY.

Q. How is the human body divided?

A. Into *head*, *trunk*, and *extremities*.

Q. How is the head divided?

A. Into *face* and *hairy scalp*.

Q. What are the parts of the face?

A. The forehead *frons*, temples *tempora*, nose *nasus*, ears *aures*, eyes *oculi*, cheeks *buccæ*, mouth *os*, and chin *mentum*.

Q. How is the hairy scalp divided?

A. Into *vertex* or crown of the head, *sin'ciput* or forepart, *oc'ciput* or hinder part, and *la'tera* or sides.

Q. How is the trunk divided?

A. Into *neck*, *thorax* or chest, *abdomen* or belly, and *pelvis*.

Q. How is the neck divided?

A. Into an anterior and posterior part. On the former there is, in males, an eminence formed, by the thyrord cartilage, called *pomum Adami*, Adam's apple, because the forbidden fruit is said to have stuck there; the latter is termed the nape of the neck.

Q. How is the thorax divided?

A. Into an anterior and posterior part, and two sides.

Q. What is the anterior part of the thorax?

A. It is termed the sternum; at its bottom is a hollow, the pit of the stomach: and the breasts are situated on each side of it.

Q. How is the posterior part of the thorax named?

A. It is called the *dorsum* or back; and the sides are called *la'tera thoracis*.

Q. How is the abdomen divided?

A. The abdomen is divided into *regions*.

Q. How many regions of the abdomen are there?

A. Three; the *epigastric*, which lies over the stomach, and whose sides are termed the *hypochon-*

driac regions; the *umbilical*, surrounding the navel, and whose sides are called the *epicolic* regions; and the *hypogastric*, whose sides are called *groins*.

Q. What is the *pubes*?

A. The part under the abdomen between the groins; beneath it lie the organs of generation.

Q. How are the extremities divided?

A. Into superior and inferior.

Q. How is a superior extremity divided?

A. Into *top of the humerus*, *brachium*, *fore-arm* and *hand*.

Q. And the hand?

A. Into *carpus*, *metacarpus*, and *fingers*.

Q. And the fingers?

A. Into *pollex*, or thumb, *index*, *di'gitus medius*, *digitus annularis*, and *digitus auricularis*.

Q. How is an inferior extremity divided?

A. Into *femur* or thigh, *crus* or leg, and *pes* or foot.

Q. How is the foot divided?

A. Into *tarsus*, *metatarsus*, and *toes*.

Q. What is the internal division of the body?

A. Into three cavities: the cavity of the cranium, thorax, and abdomen.

Q. How is the whole of the body covered?

A. By what are called the *common integuments*, so called, as being common coverings to the whole of the body.

Q. Which are they?

A. They consist of the *epidermis*, *rete mucosum*, *cutis*, and *membrana adiposa*.

Q. What is the epidermis?

The epidermis, scarf-skin, or cuticle, is a thin, pellucid, insensible membrane, covering the whole external surface of the body. It is perforated by the hairs, and the inhaling and exhaling vessels.

Q. Does the epidermis cover only the external surface of the body?

A. No; it covers also many of the internal parts as the interior of the nose, mouth, &c.

Q. Is it of the same thickness throughout?

A. No; it varies considerably; it is extremely delicate, for example, on the lips and tongue; very thin at the finger-ends and on the face, and very thick on the soles of the feet and palms of the hands. It may be farther observed, that sensation is most exquisite where the epidermis is thinnest; hence, we feel most accurately with the tips of the fingers, and hence in a great measure arises the pleasure of kissing.

Q. What is the colour of the epidermis?

A. White.

Q. Is it so in all men?

A. Yes; even in the blacks.

Q. Whence then arises their peculiar colour?

A. From the next integument—the rete mucosum.

Q. What is the *rete mucosum?*

A. A mucous substance, disposed in a net-like form, between the epidermis and the cutis.

Q. What is its colour?

A. In Europeans it is white, in Africans black, &c.

Q. Is it of a uniform thickness?

A. No; it varies like the epidermis, and in the same parts.

Q. What is the *cutis?*

A. The cutis, dermis, or true skin, is an elastic, sensible, very porous and thick membrane, lying between the rete mucosum and the adipose membrane, and covering the whole body.

Q. What is its structure?

A. It is of a fibrous, vascular, and nervous structure; and from its surface every where, project in great numbers, *nervous* fibrils, called *papillæ*, which constitute the organ of touch; these are of various forms, and most exquisitely sensible on the lips, finger-ends, &c.

Q. What is the use of the cutis?

A. To cover the whole body, and to afford a situation for the organs of touch, and the exhaling and inhaling vessels.

Q. When on the subject of the absorbents, you mentioned the mode of inhaling; but what is exhaling?

A. Exhaling, or perspiring, is a species of secretion, by which the exhaling vessels of the skin free the blood of a quantity of aqueous fluid.

Q. How many kinds of perspiration are there?

A. Two; the *insensible* and the *sensible*: the former is continually going on, and by means of it the surface of the body is kept moist and smooth.

Q. Can this be observed?

A. Yes; if you hold any part of the body near a looking-glass, the glass will become soiled.

Q. Can the latter kind be observed?

A. Yes; the latter kind of perspiration, called *sweat*, may be frequently observed.

Q. What are the *nails?*

A. The nails, *ungues*, are horny substances, situated at the ends of the fingers and toes. They are supposed to be a continuation of the cuticle.

Q. What is their use?

A. To defend the nervous papilla from contusion, as the ends of the fingers and toes are so much exposed.

Q. What are *hairs?*

A. Hairs, *pili*, are thin, elastic, dry filaments, that grow out of the skin.

Q. What is their origin?

A. They arise from bulbs, situated in the cellular membrane under the skin; each bulb has two capsules or little bags, containing an oily fluid, which is supposed to give colour to the hair.

Q. Where is the hair situated?

A. In various parts of the body.

Q. Have those different portions of hair peculiar names?

A. Yes; the hairs of the head are termed *capilli;* those above the eyes, *supercilia*, or eye-brows; those on the edges of the eyelids, *cilia;* those of the upper lip, *mystex;* on the lower jaw, *barba*, beard, &c. &c.

Q. What is the colour of the hair?

A. Various—black, brown, red, &c.

Q: What is the membrana adiposa?

A. The membrana adiposa, called also *cellular* *membrane*, *cellular tissue*, *membranous tissue*, &c., is the last of the integuments, and is composed of lamina, and of a fibrous texture, so disposed as to form cells, and a web-like structure.

Q. Does it extend to the whole of the body?

A. Yes; it may be found almost every where, connecting all the parts of the body, which appears from the manner in which butchers blow up their meat.

Q. Do the vessels of the cellular membrane secrete?

A. Yes; they sometimes separate oil from the blood, and it then becomes *adipose membrane*.

Q. Does this take place in all parts?

A. No; some parts, as the lungs, are without fat.

Q. What is the use of the cellular membrane?

A. It is of the most important use; it connects parts together; it forms the bed for the origin of the absorbents; by its elasticity it allows of friction, without deforming the part, and it forms the substance of almost all the membranes.

CHAP. XV.

SPLANCHNOLOGY—(*continued*).

Of the Head.

Q. How are the parts of the head divided?

A. Into external and internal.

Q What are the external parts?

A. The common integuments, hair, a tendinous expansion, three pair of muscles, the pericranium, and the cranium.

Q. What are the internal parts?

A. The dura mater, membrana arachnoi′dea, pia mater, cerebrum, cerebellum, medulla oblongata, nine pair of nerves, four arteries, and twenty-two venous sinuses.

Q. What is the *dura mater?*

A. A strong, thick, insensible membrane, covering the external surface of the brain, and situated immediately under the cranium, to which it adheres firmly.

Q. What is the use of this membrane?

A. To nourish the internal table of the skull; to cover the brain, and form processes, which prevent one part from pressing on another, and to afford a place for the blood to collect and pass out of the cranium.

Q. What is the *membrana arachnoidea?*

A. A very delicate transparent membrane, lying between the dura and the pia mater, and surrounding all parts of the brain.

Q. Whence has it derived its name?

A. From the resemblance of that part of it which lies about the basis of the cranium to a spider's web.

Q. What is the *pia mater?*

A. The pia mater is the third and innermost covering of the brain. It is an extremely vascular and delicate membrane, which embraces closely all the parts of the brain, which it covers and penetrates between their convolutions.

Q. What is the use of it?

A. Its use is to distribute the blood to various parts, by affording a convenient situation for the central arteries to spread on.

Q. What is the cerebrum?

A. The cerebrum, or brain, is a large viscus of rather an oval form, situated in the cavity of the cranium.

Q. Does the word brain denote only the cerebrum?

A. No; in common language the brain signifies the whole contents of the skull, *viz.* the cerebrum, cerebellum, and medulla oblongata.

Q. Of how many substances is the brain composed?

A. Of three; the medu′llary, co′rtical, and black substance.

Q. What is the medullary substance?

A. It is a substance of a delicate white colour, and composes the greater part of the brain.

Q. What is the cortical substance?

A. A substance of a brownish colour, which encircles the whole brain, and is also found in many of the internal parts. It is softer than the medullary substance.

Q. How may the *black substance* be observed?

A. In order to get a view of the black substance, so named from its colour, you must make a transverse section through the *crura cerebri*, in which it is situated.

Q. You speak of the crura cerebri, or legs of the brain: pray what is the shape of that viscus?

A. On viewing the superior surface of the cerebrum, it appears a convex oval, with a large fissure dividing it into two *hemispheres*. These are united above and below, and by their union cavities are formed called *ventricles;* the portions of the brain which unite the hemispheres are called *com'missures.*

Q. What is the form of the under surface?

A. The under surface is more irregular than the upper one, and does not at first appear to be composed of hemispheres; but by a deep division they may be perceived. It presents six distinct *lobes*, which correspond to the six depressions or *fossæ*, in the basis of the skull which they fill.

Q. But where are the crura cerebri?

A. Upon the under surface of the brain, between the middle lobes, two processes are sent downwards and backwards like legs; these are termed the *crura cerebri.*

Q. What is the appearance of the brain when the pia mater is removed?

A. On the removal of the pia mater, the brain has somewhat of the appearance of an irregular convoluded mass, heaped up together, with spaces between the convolutions, which allow the processes of the pia mater to pass some way down between them.

Q. Is not the *pineal gland* a part of the cerebrum?

A. Yes; there is an elevated line on the side of each *thalamus nervi optici*, or place where the optic nerve arises; these lines run backwards and meet, and at their point of meeting they have a small heart-shaped, pulpy substance attached to them, which is the pineal gland.

Q. What is remarkable concerning the pineal gland?

A. It was considered by many to be the seat of the soul, but that notion has been long abandoned.

Q. What nerves arise from the cerebrum?

A. Only three pair; the olfactory, optic, and motores oculorum.

Q. What is the *cerebellum?*

A. The cerebellum, or little brain, is of a round figure, and situated in the inferior occipital depressions.

Q. How is it divided?

A. It is divided into two *lobes* by a process of the dura mater, and sends forward four *crura*, which, with the crura of the cerebrum, appear to constitute the *medulla oblongata.*

Q. What is it composed of?

A. It is composed like the brain of a cortical and a medullary substance; it is, also, closely covered by the pia mater.

Q. What is the *medulla oblongata?*

A. A white, firm, medullary substance, situated beneath the cerebrum, and before the cerebellum, and lying upon the cuneiform, or wedge-shaped process of the occipital bone.

Q. What is its shape?

A. It is broad and round above, and narrow below.

Q. Where does it terminate?

A. It is continued into the spinal marrow.

Q. What appears to be its origin?

A. Its appearance would, as said before, lead to the idea of its being formed by the crura cerebri, encompassed by the crura cerebelli, becoming flattened as they pass over the former.

Q. How many pair of nerves arise from it?

A. From different parts of it and the cerebellum, arise six pair, making, with the three pair that arise from the cerebrum, the nine pair of cerebral nerves.

Q. What is the *medulla spinalis?*

A. The medulla spinalis, or spinal marrow, is a continuation of the medulla oblongata, beginning from the great occipital foramen, and passing down the vertebral canal through the cervical dorsal and lumbar vertebræ, where it terminates in a vast number of long nerves, which, from their resemblance to a horse's tail, are called the *cauda equina.*

Q. How is it composed?

A. Like the cerebrum, &c., it is composed of medullary and cortical substance; the former external, and the latter internal.

Q. Has it any covering besides the vertebral column?

A. Yes; the pia mater, &c. accompany it along its whole course.

Q. How many pair of nerves does it give off?

A. The thirty pair of spinal nerves.

Q. Can you mention any experiments that tend to prove that the brain is the organ of sensation?

A. If any nerve be divided or compressed, the muscle to which it goes becomes paralytic. If any part of the brain be irritated, dreadful convulsions take place all over the body. If any part of the brain be compressed, that part of the body which has nerves from the compressed part is deprived of motion.

Q. Is the manner of this action of the brain and nervous system known?

A. No; various hypotheses have been started, none of which, however, are satisfactory.

Q. What organs seem to exert the most influence on the brain?

A. The heart and stomach. The energy of the brain seems to depend in a great measure on the quantity of blood it receives; and the considerable mutual action of the brain and stomach on each other has been already noticed.

CHAP. XVI.

SPLANCHNOLOGY—(*continued*).

Q. WHAT are the eyes?

A. The eyes are the organs of vision.

Q. Where are they situated?

A. In the orbits at each side of the nose.

Q. How are the parts of the eye divided?

A. Into external and internal.

Q. What are the external parts?

A. The *supercilia*, or eyebrows; the *pal'pabræ*, or eyelids; the *puncta lacryma'lia;* the *lacrymal gland;* the *carun'cula lacryma'lis;* the *plica luna'ris;* and the *tu'nica conjuncti'va.*

Q. What are the eyebrows?

A. They are layers of hair which begin at the root of the nose, and form an arch over the eye.

Q. What is their use?

A. To shade the eye from too strong a light, and to defend it from the sweat flowing down the forehead.

Q. How are the eyelids formed?

A. The eyelids are formed externally by the common integuments and cartilage; inwardly they are covered by the conjunctive membrane and Meibomius' glands, which secrete a sebacious substance that facilitates the motion of the eyelids. The eyelids, especially the upper, are very moveable.

Q. What is the use of the eyelids?

A. To cover the eye during sleep, to defend them from dust and other substances, and from too much light.

Q. What are the *puncta lacrymalia?*

A. Two small orifices, one of which is seen at the end of each eyelid near the nose. From each of these a canal goes downwards, and meeting at about half an inch from their origin, they form a bag called *saccus lacrymalis,* which is continued down into the nose. The tears are absorbed by the puncta lacrymalia, and so conveyed into the nose.

Q. Where is the lacrymal gland situated?

A. In the superior part of the orbit; it secretes the tears, and pours them over the surface of the eye.

Q. What is the *caruncula lacrymalis?*

A. A small red tubucle in the internal corner of each eye; it directs the tears into the puncta lacrymalia.

Q. What is the *plica lunaris?*

A. A fold of the *tunica conjunctiva*, situated between the caruncula lacrymalis and the ball of the eye. This is very large in birds, and forms what is called the *nictitating membrane.*

Q. What is the *tunica conjunctiva?*

A. A transparent membrane lining the inside of both the eyelids, and passing over the ball, to which it adheres firmly. Its adhesion to the *cor'nea transpa'rens* is so strong that it cannot be separated.

Q. What is its use?

A. To lubricate the eye by the moisture secreted from its transparent arteries.

Q. What are the internal parts of the eye?

A. The internal parts of the eye which, taken together, constitute the bulb or ball, are, the *sclero'tic membrane*, the *tu'nica choroi'dea*, the *pigment*, the *re'tina*, and the *vi'treous humour*, the *aqueous humour*, and the *chrys'talline lens.*

Q. What is the *sclerotic membrane?*

A. A firm, hard, white, horny tunic, into which the muscles of the eye are inserted. The anterior part of it projects somewhat, and is transparent; it is called the *cornea transparens*, to distinguish it from the other part, which is called the *cornea opa'ca.* The optic nerve is inserted into the posterior part of the sclerotic membrane, which appears to be an expansion of its external tunic continued from the dura mater.

Q. What is the *membrana* or *tunica choroidea?*

A. A soft rough membrane, lying immediately under the sclerotic membrane, to which it adheres from the optic nerve, all round to the edge of the transparent cornea, where, instead of being continued across, it turns downwards and inwards, and forms the coloured part of the eye called the *iris.*

Q. Is there any thing remarkable concerning the iris?

A. Yes; it has the power of enlarging or contracting the opening in its centre, called the pupil, so as to regulate the quantity of light admitted into the eye.

Q. What is the *pigment?*

A. A black mucus which covers the posterior surface of the membrane choroides.

Q. What is the *re′tina?*

A. A whitish pulpy vascular membrane covering the pigment of the choroides. It is an expansion of the optic nerve and the seat of vision.

Q. What is the *vitreous humour?*

A. A soft, round, and transparent substance filling the posterior part of the eye. It is contained in a delicate membraneous capsule, and fills about three-fourths of the globe of the eye.

Q. What is the *chrystalline lens?*

A. A solid, lenticular, transparent mass, suspended in a capsula* in front of the vitreous humour, and immediately behind the pupil.

Q. What is the *aqueous humour?*

A. A very fluid transparent substance, like water, which fills the chambers of the eye.

Q. What are the chambers of the eye?

A. The space between the chrystalline lens and the cornea transparens, is divided into two compartments by the iris, which hangs like a curtain in the middle. These spaces are called the *anterior* and *posterior chambers.*

Q. How is vision performed by the eye?

A. The rays of light which fall from a point in an object, or the cornea transparens are transmitted, and so affected by the humours, as to converge to a point on the retina. Thus, an image corresponding to the object, is formed on the retina, and the impression transmitted by the optic nerve to the brain, producing a sensation in the mind.

Q. What is the *ear?*

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* Cap′sula, a little bag.

A. The organ of hearing.

Q. How is it divided?

A. Into the external and internal ear.

Q. How is the external ear formed?

A. It is formed of an oval cartilage, covered with the common integuments. It is concave before, and convex behind, and has several eminences and depressions.

Q. How are the external and internal ears connected?

A. By the auditory canal. This canal is bony, lined by a cartilage and the common integuments, between which are the glands which secrete the wax.

Q. Where is the internal ear situated?

A. It lies within the petreous portion of the temporal bone, and consists of various bones and recesses filled with a soft matter, which form the more immediate organ of hearing.

Q. How is the auditory nerve disposed?

A. It is expanded, in a very beautiful manner, like a fan or beard on some of the membranes of the internal ear, very much resembling the expansion of the optic nerve in the eye.

Q. How is hearing performed?

A. The rays of sound, from a sounding body, arrive at the outer ear, which, by its form and elasticity, collects them; they then pass along the auditory canal to a membrane called the membrana tympani, which vibrates, and communicates its vibrations to the bone called the malleus, the malleus to the incus, it to the os orbiculare, and the os orbiculare to the stapes. The basis of the stapes sits within the part called the *vestibule*, and communicates its motion to the watery fluid which fills the vestibule, labyrinth, and other cavities, and so to the nerve which is in contact with the water, and is thus propagated along to the brain, the seat of sensation.

Q. Give a description of the *nose*.

A. The nose, the organ of smell, is a prominence in the face, between the eyes and the mouth, and consists of an external and an internal part.

Q. What are the parts of the external nose?

A. The *root*, the part contiguous to the forehead; the *back* or *bridge*, the middle prominence; the *alæ* or *pinnæ*, the lateral and moveable parts; the *apex* or *tip*.

Q. What are the parts of the internal nose?

A. The *nostrils*, the *cartilages*, and the *sinuses*.

Q. What are the cartilages of the nose?

A. One in the middle, which, with the *vomer*, forms the partition between the nostrils; and two on each side of this partition, which form the tip and the opening into the nostrils.

Q. Which are the principal sinuses?

A. Those called the frontal, which communicate with the upper part of the nostrils. In what is called a cold in the head these are the parts principally affected.

Q. Is there any particular membrane within the nose?

A. Yes; the nostrils and the sinuses are lined by the *pituitary membrane*, upon which the excretory ducts of the mucous glands open. The olfactory nerves are beautifully distributed over this membrane.

Q. How is smelling performed?

A. The odoriferous particles of bodies float in the air and are carried into the nostrils, particularly in the act of inhalation, and come in contact with the olfactory nerves which communicate with the brain, and thus produce a sensation.

Q. Is the nose only useful as an organ of smell?

A. The nose is also of great use in respiration and speech. For example, the letter *n* could not be properly pronounced without the aid of the nose.

Q. What are the principal parts to be considered in the *mouth?*

A. The cheeks and lips that cover it; and the gums, palate, and tongue, which lie within it.

Q. What are the cheeks composed of?

A. Of common integuments and muscles.

Q. Of what are the lips composed?

A. They, also, are composed of common integuments and muscles; they are also highly vascular; and hence arises their beautiful red colour when in health.

Q. What are the *gums?*

A. A red, vascular, spongy substance of a peculiar nature, encompàssing the necks of the teeth.

Q. Do the gums secrete any particular substance?

A. Yes; the edges of the gums secrete the *tartar*, which is found on the teeth.

Q. What is the *palate?*

A. The palate is the roof of the mouth, and consists of two parts—the hard palate and the soft palate.

Q. Which is the hard palate?

A. That which is in the anterior part of the mouth, formed of the palate bones, and the palatine portions of the upper maxillary bones; it is covered with periostrum and the common membrane of the mouth, which is formed into *rugæ* or wrinkles.

Q. What is the soft palate?

A. The soft palate extends backwards from the hard palate, and is composed of the internal membrane of the mouth, of glands and muscles. From the middle of it there hangs down over the tongue a conical body, like a nipple, called the *u'vula.*

Q. What is the use of the mouth?

A. The mouth is of the most important use in mastication and deglutition; it forms a passage for the air in breathing, and assists in forming the voice.

Q. What is the process of mastication?

A. The food which enters the mouth is continually thrust by the tongue between the teeth of the upper and under jaws, and is there ground by the motion of the latter on the former; the cheeks and lips hinder it, when ground, from falling out of the mouth. During this process the food is well broken and mixed with the saliva and mucus of the mouth, and thus prepared for deglutition.

Q. What is the *tongue?*

A. A muscular body, moveable in every direction, and situated in the bottom of the mouth.

Q. How is it divided?

A. Into a base or root, body, back, inferior surface, and two sides.

Q. What is the *frenum* of the tongue?

A. A part of the membrane of the mouth which, like a bridle, connects the lower surface of the tongue with the parts below. It is just behind the middle incisores, and from its being sometimes too short, and preventing the free motion of the tongue, it is necessary to cut it.

Q. Of what is the tongue composed?

A. Of a number of muscular fibres covered by the common integuments.

Q. What is the use of the tongue?

A. It is the organ of taste, and assists in chewing, swallowing, &c.

Q. How is tasting performed?

A. The external surface of the tongue is covered with nervous papillæ, with which the particles of bodies come in contact.

CHAP. XVII.

SPLANCHNOLOGY—(*continued*).

Q. How is the neck divided?

A. Into external and internal parts; the former consisting of common integument, muscles, nerves arteries, veins, &c.; the latter of the fauces, pharynx, œso′phagus, larynx, and trache′a.

Q. What are the fauces?

A. The cavity behind the soft palate and the tongue.

Q. What is the use of the fauces?

A. For swallowing, breathing, speech, and hearing.

Q. How for hearing?

A. By means of the *eustachian tubes*, one end of which opens into the fauces, and the other into the tympanum of the ear.

Q. What is the *pharynx?*

A. A muscular sac, shaped like a funnel, adhering to the fauces, and situated behind the larynx.

Q. What is the *œso′phagus?*

A. The œsophagus or gullet is a membranous muscular tube between the pharynx and stomach; it consists of three coats or tunics—a common, a muscular, and a villous one. Its office is to convey the food into the stomach.

Q. What is the process of deglutition?

A. When the food is masticated the jaws are shut, and the tongue is applied to the palate, so that the food, lying upon the back of the tongue, is pressed into the cavity of the fauces, where it is received by the pharynx. The pharynx, being irritated, contracts, the food is driven into the œsophagus, which, also contracting, it is finally conveyed into the stomach.

Q. What is the *larynx?*

A. A hollow tube, composed of cartilage, muscles, and ligaments. It is situated at the root of the tongue, and in the fore-part of the neck.

Q. What is the *glottis?*

A. The opening of the larynx into the mouth.

Q. How is the passage of food into the larynx prevented?

A. By the *epiglottis*, an oval cartilage, which covers the glottis when the food is passing into the pharynx.

Q. What is the use or the larynx?

A. To form the voice, and to give a passage to the air into and out of the lungs.

Q. How is the voice formed?

A. By the sound of the air propelled, by the larynx and its muscles, through the glottis.

Q. On what does the difference of voice chiefly depend?

A. On the diameter of the glottis, its mobility, &c.,

and the force with which the air is expelled. Thus when the diameter is increased, the voice becomes more bass. In women and boys, the diameter of the glottis is less by one-third than in men; hence the difference of their voices.

Q. What is the trachea?

A. A tube composed of cartilage, membranes, and muscles, which descends from the larynx into the thorax, where it divides into two branches, called *bronchiæ*.

Q. What is its use?

A. To convey the air into and out of the lungs.

CHAP. XVIII.

SPLANCHNOLOGY—(*continued*).

Q. How is the thorax divided?

A. Into external and internal.

Q. What are the external parts?

A. The common integuments, muscles, bones, and the breasts.

Q. What are the principal internal parts or viscera of the thorax?

A. The pleura, the lungs, the pericardium, and heart, besides the œsophagus, the arch of the aorta, and many other arteries, veins, and nerves.

Q. What are the *breasts?*

A. The breasts, or mammæ, are two soft hemispheres, adhering to the anterior lateral parts of the chest, over the pectoral muscle.

Q. What is their structure?

A. They are composed of a quantity of soft fat, whence they derive their softness and roundness, and of a great number of glands, well supplied with blood-vessels and nerves, which secrete the milk.

Q. What is the *nipple?*

A. The nipple or papilla is a very irritable soft body, in the centre of each breast, into which the ducts of the glands open.

Q. What is the use of the breast?

A. To secrete and contain the milk for the use of the new-born babe.

Q. What is the *pleura?*

A. A transparent membrane, lining each lateral cavity of the thorax, and covering its viscera.

Q. How are these cavities formed?

A. The pleura of each, on arriving at the vertibræ, turn and go forward towards the sternum, without coming into contact with each other, and between them there is interposed a great quantity of cellular substance, which thus divides the thorax into two cavities.

Q. What is this partition called?

A. It is called the *mediasti′num,* and it contains the pericardium, œsophagus, and several other important parts.

Q. What are the *lungs?*

A. Two viscera situated in the cavities of the thorax.

Q. What is their use?

A. It is by means of them that we breathe, and they produce an important change in the blood.

Q. How are they divided?

A. Into right and left lungs: the right has three *lobes;* the left but two.

Q. Of what do they consist?

A. Of bronchia, vesicles, vessels, nerves, glands, and parenchy′ma.

Q. What are *vesicles?*

A. The vesicles of the lungs are a kind of air-bags: they form by far the greater part of the lungs, and are placed at the extremity of the ramifications of the bronchia, and are probably formed of the membrane which lines it.

Q. What is the parenchyma of the lungs?

A. The cellular substance which connects the vessels, bronchia, and vesicles.

Q. What is the process of respiration?

A. The external air rushes into the lungs through the trachea; this is called *inspiration.* It irritates the nerves, which irritation is communicated to the diaphragm and intercostal muscles, and compels them to contract, and the chest consequently dilates. The stimulus ceasing, these muscles relax, the chest contracts, and the air is expelled; and this is termed *expiration.*

Q. What is the *pericardium?*

A. A membraneous sac, containing the heart.

Q. What is its use?

A. To contain the heart, and to secrete a fluid to lubricate it.

Q. What is the *heart?*

A. A hollow, muscular viscus, situated at the left side of the thorax, in the cavity of the pericardium.

Q. What is the structure of the heart?

A. It is entirely muscular, and well supplied with vessels. Its cavities are lined with a very smooth membrane.

Q. How is the heart divided?

A. Into two auricles at its base, two ventricles or cavities in its interior, and the arteries and veins which proceed from and terminate in it.

Q. What are the *auricles?*

A. They are muscular sacs divided into a right and a left auricle. They have on them little processes like ears, whence their name. In the right auricle the venæ cavæ terminate, and it opens into the right ventricle; the left auricle receives the pulmonary veins and opens into the left ventricle.

Q. What are the *ventricles?*

A. Cavities within the heart, and below the auricles which open into them; the pulmonary artery proceeds from the right, and the aorta from the left ventricle.

Q. What may be further remarked of the ventricles?

A. That they have valves of a peculiar construction, placed at the entrance into them and egress from them.

Q. What is the position of the heart?

A. Its base or broader end lies towards the dorsal vertebræ, its apex or point towards the sixth rib; so that it lies obliquely, the right venticle being anterior and the left posterior, and its under surface on the diaphragm.

Q. What is the use of the heart?

A. To propel the blood through the body.

Q. What is the process of *circulation?*

A. Supposing circulation to commence, the left ventricle being full of blood, and its muscles stimulated by the presence of that fluid, it contracts and forces the blood into the aorta, and its return is prevented by the valve placed at the commencement of that artery. It now proceeds along the aorta, and is impelled into all the branches of the arteries to their most minute ramifications, when they anastomose with the veins.

Q. What then becomes of it?

A. The veins receive it, carry it back, receiving the chyle, on the way, from the thoracic duct, and discharge it into the right auricle, which sends it into the right ventricle, and being in its present state unfit for circulation, it proceeds along the pulmonary artery into the lungs, when it is exposed to the contact of the air contained in the vesicles, and is returned of a florid red colour to the left auricle, which sends it into the left ventricle, and it then proceeds along the aorta as before.

CHAP. XIX.

Splanchnology—(*continued*).

Q. What is the *abdomen?*

A. The cavity between the thorax and the pelvis.

Q. What are the viscera it contains?

A. The omentum, stomach, small and large intestines, liver, mesentery, spleen, pancreas, and kidneys.

Q. What is the membrane lining the abdomen called?

A. It is called the *peritonéum*, and its use is to cover the viscera, and exhale a vapour to moisten them.

Q. What is the *omentum?*

A. An adipose membrane attached to the stomach, and lying on the anterior surface of the intestines.

Q. What is its use?

A. The same as that of the peritoneum, of which it is a production or continuation.

Q. What is the *stomach?*

A. A membraneous bag lying in the epigastric región.

Q. What is its use?

A. To receive the food from the œsophagus, and to mix and digest it.

Q. What is the structure of the stomach?

A. It consists of three coats—a peritoneal, a muscular, and a villous coat.

Q. What is its shape and position?

A. It is formed like the bag of a bagpipe, and it lies across the epigastric region of the abdomen. It has two apertures; one superior, called the *cardia*, communicating with the œsophagus, by which it receives the food; the other inferior, called the *pylórus*, by which it transmits the digested food to the intestines.

Q. What is the process of digestion?

A. The food, when received into the stomach, is there mixed with the *gastric juice*, which reduces it to an uniform soft pulpy substance, called *chyme*, which, by the peristeltic or contractile motion of the stomach, is passed into the duodénum.

Q. What are the conditions of healthy digestion?

A. A proper degree of heat in the stomach, a due mixture of *saliva* with the food in the mouth, a sufficient quantity of gastric juice, a regular *peristaltic* motion, and a pressure resulting from the contraction and dilatation of the abdominal muscles and diaphragm.

Q. What are the intestines?

A. A membranous tube, which is six times as long as the body; it lies in the cavity of the abdomen, extending from the pylorus to the anus.

Q. If such be its length, how is it contained in so small a space?

A. It is variously twisted and contorted, and by that means fitted to its receptacle.

Q. How are the intestines divided?

A. Into the *small* and the *large* intestines.

Q. Which are the small intestines?

A. The *duodénum,* the *jejúnum* and the *íleum.*

Q. Which are the large intestines?

A. The *cæcum,* the *colon,* and the *rectum.*

Q. What is the use of the intestines?

A. To receive the chyme from the stomach, to mix it with the bile and other fluids, to seperate the *chyle,* and to expel the fœces.

Q. What is the process of *chylification?*

A. The chyme being received into the duodenum, it is there mixed with the bile, the pancreatic juice and the enteric juice, by which mixture a fluid, like milk, called *chyle,* is separated, which is taken up by the lacteal vessels and conveyed to the thoracic duct to be sent to the blood to form new blood. It is in order that the lacteals may be able to take up the whole of the chyle that the intestines are of so great a length; for the lacteal vessels are exceedingly numerous, and extend through the greater part of the intestinal canal.

Q. What space of time does this process occupy?

A. The whole process of chymification and chylification takes up about three hours: the latter process is the longest on account of the length of the intestinal canal.

Q. What is the *mes'entery?*

A. A membraneous production of the peritoneum.

Q. What is its use?

A. Its chief use is to sustain and give a peritoneal coat to the intestines.

Q. What is the *liver?*

A. The liver is a large gland composed of arteries, veins, nerves, &c., and its office is to separate the fluid called the bile or gall.

Q. How is it divided?

A. Into three *lobes*, one of which is very large, another smaller, and a third very small.

Q. What becomes of the separated bile?

A. It proceeds along the *hepátic duct* into the duodenum.

Q. What is the *gall-bladder?*

A. A membraneous bag situated under the liver, to which it adheres very firmly.

Q. What is the use of the gall-bladder?

A. To retain the gall which regurgitates from the hepatic duct, which becomes there thicker and more bitter and acrid, and to expel it when wanting into the duodenum.

Q. What is the name of the tube by which it transmits the gall to the duodenum?

A. The *cystic duct.*

Q. What is the *spleen?*

A. A spongy viscus, of a bluish-red colour, situated near the bottom of the stomach under the ribs.

Q. What is its use?

A. Its use is unknown. Some think it has been put in merely as *package*, to prevent the other viscera being thrown out of their places by the friction and motion of the body.

Q. What is the *pancreas?*

A. A glandular body, shaped like a dog's tongue, and situated under the stomach.

Q. What is its use?

A. To secrete a fluid resembling saliva, and to discharge it into the duodenum.

Q. What is the pancreas of a beast generally called?

A. It is called the *sweetbread.*

Q. What are the *lacteal vessels?*

A. The absorbing vessels of the mesentery, which take up the chyle from the intestines, and convey it to the thoracic duct.

Q. What are the *kidneys?*

A. Two oval viscera, situated near the lumbar vertebræ.

Q. What is their use?

A. To secrete the urine, and convey it into the urinary bladder.

Q. What is the *urinary bladder?*

A. The *vesica urina'ria* is the principal viscus of the pelvis.

Q. What is its shape and use?

A. It is a membraneous sac of a round form, and its use is to receive the urine from the kidneys and expel it.

Q. Where does the urine enter it?

A. At the inferior part, near the neck; the tubes that convey it thither from the kidneys are called *urèters*, and that by which it is expelled the *urèthra.*

CHAP. XX.

HYGROLOGY.

Q. How are the fluids divided?

A. Into *crude*, as the chyle; *sanguineous*, as the blood; *lymphatic*, as the lymph; *secreted*, as when separated from the blood; and *excrementitious*, as the urine.

Q. How are the secreted fluids subdivided?

A. Into *lacteal*, *aqueous*, *mucous*, *albu'minous*, *oleous*, and *bilious*.

Q. What is blood?

A. A red fluid circulating in the heart, arteries, and veins.

Q. Is its colour always the same?

A. No, in the heart and arteries it is of a *florid* red colour; in all the veins, except the pulmonary, it is of a much darker hue.

Q. When blood is exposed to the atmosphere what change does it undergo?

A. It separates into two portions; the *serum*, which is a fluid; and a thick cake, called *cruor* or *crassamentum*, which floats in the serum.

Q. What is the use of the blood?

A. To generate and propagate heat in the body, to nourish all the parts of it, and to supply all the secretions.

Q. Name some of the other principal fluids.

A. The milk, the gastric juice, the bile, the enteric and pancreatic juices, the urine, &c.

Q. What is the *gastric juice?*

A. A limpid colourless fluid, secreted by the exhaling vessels of the numerous arteries, which lie in every part of the stomach. Its use is to digest the food.

Q. What is the *bile?*

A. A greenish-yellow liquor, secreted by the liver, and conveyed into the duodenum to assist in separating the chyle.

Q. What is the *enteric juice?*

A. A limpid liquor secreted by the exhaling arteries along the whole course of the intestines.

Q. Are the fluids of the body numerous?

A. Exceedingly so; there is scarcely any part that has not some fluid peculiar to it. Thus the eye has tears, besides its humours; the ear its wax; the nose the mucus that lubricates its interior surface; the mouth the saliva, and so on.

Q. What reflection naturally arise from the consideration of the structure of the human body?

A. That we are "fearfully and wonderfully made," and that some superior Intelligence must have presided over the formation of so wonderful a machine, whose creatures we consequently are, and whose laws we are bound to obey.

FINIS.

PRINTED BY COX AND BAYLIS, GREAT QUEEN STREET.

ERRATA.

Page	Line				
17	7	for	*syon'physis*	read	*sym'physis.*
18	8	—	member	—	membrane.
30	18	—	per	—	par.
—	29	—	subclevian	—	subclavian.
32	33	—	*crusal*	—	*crural.*
35	9	—	*vina*	—	*vena.*
—	23	—	*diptals*	—	*digitals.*
36	4	—	*sal'litum*	—	*satel'litum.*
—	5	—	brachiel	—	brachial.
—	13	—	brechial	—	brachial.
—	32	—	*frontel*	—	*frontal.*
—	—	—	*faciel*	—	*facial.*
—	—	—	*linguel*	—	*lingual.*
—	39	—	meter	—	mater.

SIR H. DAVY.

PINNOCK'S

Catechism

OF

CHEMISTRY,

intended to assist the Learner in unfolding the

Secrets of Nature.

LONDON,

Publiſhed by Whittaker, Treacher & Arnot, 13, Ave Maria Lane.

1829.

Perkins & Heath, Patent Hardened Steel Plate